

ABSTRACT OF THE DISCLOSURE

A hydraulic actuator is disclosed having a cylinder with a piston that is moved by hydraulic fluid. A laser diode emits a pulse or pulses of light that form laser light beam. These pulses are provided to two or more optical fibers that extend into two or more corresponding cylinders. For each of these cylinders, the optical fiber enters the cylinder at one end of the cylinder and directs a laser beam into the cylinder, and off the piston where the beam is reflected. The reflected beam then exits the cylinder through at least two corresponding optical fibers disposed on either side of the fiber that conducted the light into the cylinder. Each of the optical fibers that receives reflected light is joined together with the others of the optical fibers into one fiber that carries the reflected beam of light to a photo-diode located remote from the cylinder. Each of the photo diodes for each of the two or more cylinders has a corresponding photo diode amplifier. The output of these amplifiers are coupled together and provided to a pulse expansion circuit. The timing circuit that generates the pulse that triggers the laser diode also generates gate pulses for each of the photo diode amplifiers. These gate signals suppress the output of all but one of the photo diode amplifiers. In this manner, the pulse expansion circuit and phase comparator circuits that receive the photo diode amplifier signals will generate an output signal indicative of the time-of-flight of the laser light pulse in only one cylinder at a time. This permits the system to select a specific cylinder and generate a signal indicative of the position of the piston within the cylinder: the time-of-flight of the laser light pulse.

09072895-060401